A NEW NAME FOR THE WELL-KNOWN *ASPLENIUM* (ASPLENIACEAE) FROM HALE COUNTY, ALABAMA

Brian R. Keener[1]

University of West Alabama
Department of Biological and Environmental Sciences
Livingston, Alabama 35470, U.S.A.
bkeener@uwa.edu

L.J. Davenport

Samford University
Department of Biological and Environmental Sciences
Birmingham, Alabama 35229, U.S.A.
ljdavenp@samford.edu

ABSTRACT

The name of the hybrid fern *Asplenium* × *ebenoides* R.R. Scott pro sp. [= × *Asplenosorus ebenoides* (R.R. Scott) Wherry] has long been misapplied to the well-known *Asplenium* species of reticulate origin from Hale County, Alabama. A new name, **Asplenium tutwilerae**, and description are provided.

RESUMEN

Se ha aplicado mal el nombre del helecho híbrido *Asplenium* × *ebenoides* R.R. Scott pro sp. [= × *Asplenosorus ebenoides* (R.R. Scott) Wherry] al bien conocido *Asplenium* de origen reticulado de Hale County, Alabama. Damos un nombre nuevo, **Asplenium tutwilerae**, y su descripción.

INTRODUCTION

The fern name *Asplenium ebenoides* was originally published by R.R. Scott (Scott 1865). He based his description on a single plant, collected in 1862, from near Philadelphia, PA on the west bank of the Schuylkill River.

As an editorial note appended to that article, Thomas Meehan suggested that the discovery might represent a fern hybrid, since only a single specimen had been found: "Is it a hybrid or variation? or, is it a species? Is it the last individual of a declining race, or is it the first creation of a new one?" The next year, Berkeley (1866) declared the plant to be a hybrid and correctly identified its parents: *Asplenium platyneuron* (L.) B.S.P. and *A. rhizophyllum* L. [=*Camptosorus rhizophyllus* (L.) Link].

Seven years later, in a list of significant collections including "Asplenium eb[e]noides R.R. Scott," D.C. Eaton (1873) announced, "A new locality for this very rare species has been found by Miss Julia S. Tutwiler near Havana, in Central Alabama. … As every fact connected with *this singular and disputed form* [emphasis added] will interest botanists in general and fernists in particular, we extract freely from Miss Tutwiler's letter, which is beside[s] brimful of botanical spirit:

> I found it in a little magic spot, a Fairy-glen, about five miles from my home. You must know that we live in Central Alabama … in a hilly country of sand and red clay, with long red gullies washed everywhere into the hills, but no rocks except pudding-stones [a type of conglomerate]. One day I happened to hear of beautiful mossy crags and cliffs some miles away, and went to seek them. To my delight and surprise, I found a little narrow glen, which seemed to have been picked up somewhere in the Blue Ridge and carried bodily through the air to be dropped down in this odd place. … There seemed a separate soil and climate to this little freak of nature. I found there five ferns which I had never seen in any other spot around us.

Most importantly, Tutwiler's list of ferns in the "Havana Glen" included *Asplenium ebenoides* and its purported parents, *A. platyneuron* ["Asplenium ebeneum"] and *A. rhizophyllum* ["Camptosorus"].

A quarter century later, in a paper on the habitats of rare ferns in Alabama, Underwood (1896) reported on his own visit to Havana Glen and raised doubts about the hybrid origin of *Asplenium ebenoides*:

> The glen is a deep gorge cut in a conglomerate rock, well wooded and shaded. [Several fern species are present.] But the object of our search is here in considerable quantity, in fact the commonest fern of the glen, *Asplenium ebenoides*. … Many have regarded it a hybrid, but the display of the species at Havana clearly demonstrates that it is not a hybrid at all. … It appears to be multiplying, as many young

[1]The University of Alabama, Biodiversity and Systematics, Tuscaloosa, Alabama 34487-0345, U.S.A.

plants were seen in the rock crevices. This myth of hybridity may be put aside, for *Asplenium ebenoides* is as clearly defined a species as we possess in the genus *Asplenium*. …

Soon after, Maxon (1900) reported on his own visit to "the somewhat famous locality" of Havana Glen. His conclusions contrasted markedly with Underwood's. He found *Asplenium ebenoides* to be quite abundant and *A. platyneuron* to be "common in the near vicinity," but its other supposed parent, *A. rhizophyllum*, was "not in great evidence, … though it had previously been found here in small quantity." The sheer number of individuals of *A. ebenoides*, despite the lack of one parent, raised the question in Maxon's mind "as to whether the fact of the fern's fertility effectually disposes of the supposition of its hybridity. May it not be a *fertile* hybrid?" And, "To my mind the supposition of hybridity for *A. ebenoides* is not weakened by the discovery of its evident fertility."

Slosson (1902) tested the origin of *Asplenium ebenoides* by forcing the hybridization of gametophytes of *A. platyneuron* and *A. rhizophyllum*, then comparing the characteristics of the resulting crosses to plants collected in various parts of the eastern United States and from Havana Glen (the latter collections by Underwood and Maxon). Her succinct conclusion: "Surely we have here convincing proof of the origin of *A. ebenoides*."

Wherry and Trudell (1930) reported on their 1929 expedition to Havana Glen, "the famous station where this hybrid spleenwort reproduces itself." They found *Asplenium ebenoides* to be "less abundant than in former years, [with] only about 25 adult plants being seen during an hour's search. It is, however, definitely reproducing itself by spores …" They also noted, "One of the parent ferns, *Asplenium platyneuron*, occurs sparingly on the same rocks, but no *Camptosorus* could be found in the vicinity."

Wagner (1954) determined the cytological reason behind the fertility of the Havana Glen population—and the unimportance of the lack of one parent. His studies of sterile *Asplenium ebenoides* from a Maryland population revealed "72 univalents, 36 from each of the parents." By contrast, the fertile Alabama population had "72 normal-appearing chromosome pairs," or 144 total chromosomes. Thus, the Havana Glen population is a natural and self-reproducing allotetraploid.

Finally, Wagner and Whitmire (1957) produced an allotetraploid by culturing the few unreduced, viable spores from a diploid *Asplenium* × *ebenoides* originally collected in Maryland. In their words, "The culture allopolyploid contrasts with the Alabama wild type in an ensemble of characters, both sporophytic and gametophytic"; these differences include blade texture, blade color, frond outline, width of pinnae, number of dwarf or abortive pinnae, form of pinnae margins, and the outline of gametophytic wings. As explanation, "Even seemingly trivial genetic differences where the parents are as distantly related as *Asplenium platyneuron* and *A. rhizophyllum* might be magnified in new combinations between them, and produce unexpectedly strong differences in the allopolyploids formed from different parental varieties in different localities."

Despite the above noted differences in chromosome complement, fertility, and morphology, "the sterile hybrid *Asplenium platyneuron* × *rhizophyllum* and its allopolyploid derivative" were treated together as *Asplenium ebenoides* in the recent *Flora of North America* treatment (Wagner et al. 1993).

DESCRIPTION

The description below is based on specimens from the only locality from which *Asplenium tutwilerae* has been collected to date—the well-published location near Havana in Hale County, Alabama. Generally referred to as "Havana Glen" (Walter et al. 1982), this north-south oriented ravine contains a maturing deciduous forest of various red oaks (*Quercus* spp.), beeches (*Fagus grandifolia* Ehrh.), and hickories (*Carya* spp.). The sides of the ravine are rather steep, encompassing roughly 30 m of elevation. An intermittent stream in the ravine bottom is surrounded by dense stands of *Illicium floridanum* Ellis. Along the upper third of the west-facing slope occur outcroppings of ferruginous conglomerate rocks that contain pebbles of quartz and chert (Fig. 1A). It is in the crevices of these rocks that *A. tutwilerae* can be found.

Asplenium tutwilerae B.R. Keener & L.J. Davenport, sp. nov. **(Figs. 1B, 2)**. TYPE: U.S.A. ALABAMA: Hale Co.: Havana, growing in shaded crevices along the upper portions of sandstone conglomerate cliffs, 28 Jul 1900, *C.J. Pollard & W.R. Maxon 335* (HOLOTYPE: US; ISOTYPES: MO, NY [2], PH [2], US).

FIG. 1. A. Ferruginous conglomerate rocks that contain pebbles of quartz and chert in which *Asplenium tutwilerae* occurs. B. *A. tutwilerae* habit.

Fig. 2. Holotype (*C.L. Pollard & W.R. Maxon 335,* US) of *Asplenium tutwilerae*.

Planta inter *A. rhizophyllo* L. et *A. platyneurone* (L.) B.S.P., species e America boreali orientali; differt a *A. rhizophyllo* frondibus latioribus ad maturitatem basi pinnatis vel pinnatifidis; differt a *A. platyneurone* frondibus ad maturitatem dimidio distali pinnatifido vel integro-subintegro.

Plants epipetric. **Roots** numerous, filiform, to 6 cm long, monopodially branching. **Rhizomes** horizontal to erect, 0.5–2 cm × 0.3–0.5 cm, imbedded by adventitious roots and bases of old and current stipes, scaly near apices; scales narrowly triangular, 1–4 mm × 0.2–0.5 mm, pellucid, essentially one cell thick, with thicker brownish black secondary walls forming areolate reticulum. **Fronds** dimorphic; smaller, mostly sterile blades usually appressed to the substrate; larger, fertile blades, ascending to erect. **Stipes** castaneous to purplish brown, lustrous, proximal 1/4 scaly, distal 1/2 pubescent; scales similar to those of rhizome, reduced to linear-triangular to linear, reticulum also reduced to consist of midvein and/or cross hatchings; pubescence of clavate, orange reddish hairs; stipes of smaller fronds 0.5–2.5 cm long, recurved; stipes of larger fronds 2.0–9 cm long, ascending to erect. **Blades** extremely variable; herbage green, opaque, not leathery, pubescent; pubescence of clavate, orange reddish hairs; smaller fronds lanceolate, 2–11 cm × 1–2 cm, pinnatifid in proximal 1/2–2/3, apices long attenuated in distal 1/3–1/2, with margins irregularly lobed or entire-serrulate, occasionally pinnately compound in proximal 1/4; larger fronds lanceolate, 7–18 cm × 2–8 cm, pinnately compound in proximal 1/4–1/3, pinnatifid for middle 1/2, apices long attenuated in distal 1/4–1/3 with margins irregularly lobed or entire-serrulate, occasionally producing viable plantlets at apex. **Rachises** castaneous to purplish brown, lustrous proximally, green, dull distally, pubescent; pubescence of clavate, orange reddish hairs. **Pinnae** of smaller fronds 0–1 pairs, ovate, 0.5–0.9 cm × 0.4–0.5 cm, bases truncate, apices obtuse, margins entire; pinnae of larger fronds 1–2 pairs, lanceolate, 0.7–2 cm × 0.4–1 cm, bases truncate to auriculate, apices obtuse to acute, margins entire to crenulate-serrulate. **Segments** of smaller fronds ovate, 0.3–1 cm × 0.2–0.4 cm, apices obtuse, margins entire to crenate-serrulate; segments of larger fronds lanceolate, 0.3–5 cm × 0.3–1 cm, apices acute to obtuse, margins entire to crenulate-serrulate. **Sori** of smaller fronds when fertile, 1–3 per pinna or segment in proximal and middle portion of frond, 1 on each side of the midrib corresponding with each lobe or tooth on distal attenuated apices; sori of larger fronds, 1–18 per pinna or segment in proximal and middle portion of frond, 1 on each side of midrib corresponding with each lobe or tooth on distal attenuated apices. **Indusia** present, membraneous, attached along one margin. **Spores** 64 per sporangium. 2n = 144.

Additional specimens examined: **UNITED STATES. ALABAMA. Hale Co.:** near Green Springs, 31 Jan 1874, *Prof. Tutwiler s.n.* (NY); northern Alabama, 1877, *Miss Tutwiler s.n.* (MO); near Havana, 20 Mar 1878, *E.A. Smith 20* (UNA [2], US [2]); Havana, 1884, *J.W.A. Wright s.n.* (NY); Aug 1890, *J.W.A. Wright s.n.* (PH); Near Havana, 16 May 1896, *L.M. Underwood s.n.* (MO [2], NY [3], US); rocky glen, Havana, 21 Dec 1898, *W. Trelease 326798* (MO); Havana, Jan 1905, *Whatley s.n.* (UNA); near Havana, Mar 1907, *J.W. Moreland s.n.* (PH); one mi N of Havana, 9 May 1929, *E.T. Wherry s.n.* (US); Havana, 11 Jul 1953, *C. O'Kelley & R. Chermock s.n.* (UNA); Havana Fern Glen, ca. 1 air mi N of Havana, 26 Jul 2006, *B.R. Keener 3023 with L.J. Davenport, R. Cobb, & N. Cobb* (UNA).

DISCUSSION

The name *Asplenium* × *ebenoides* has been misapplied to the Havana Glen population since its discovery in the latter half of the 19th century. In a summary paper published 15 years after his determination of the allotetraploid nature of that population, Wagner (1969) argued for a "single, simple approach" to the naming of hybrids, "such as using the hybrid binomial. … *The question of whether a given hybrid is 'fertile' or 'sterile,' diploid or polyploid, is not pertinent* [emphasis added]." We, however, argue just the opposite: The Havana Glen population of *Asplenium tutwilerae* is sexually viable and on its own evolutionary track; therefore, it should be recognized as a distinct species separate from *A.* × *ebenoides*.

Asplenium tutwilerae qualifies as a distinct species under the Biological Species Concept (Mayr 1963) due to its being a sexually reproducing population that is reproductively isolated. It also qualifies under various phylogenetic species concepts in that it represents a distinct and unique monophyletic lineage (Baum & Donoghue 1995; Mayden 1997).

Reticulate evolution by means of a hybridization event has been well documented in the genus *Asplenium* (Smith & Levin 1963; Wagner 1954; Werth et al. 1985b). Two other Aspleniums that have arisen in a

fashion similar to *Asplenium tutwilerae* are currently designated as distinct species, *A. pinnatifidum* Nuttall and *A. bradleyi* D.C. Eaton (Wagner et al. 1993). It is worth noting that both of these are believed to have originated in more than one location (Werth et al. 1985a) while *A. tutwilerae* is known currently to have a single origin.

With a single origin and a single population, *Asplenium tutwilerae* immediately assumes its place as one of the rarest fern species in the world. Efforts must begin to insure its preservation.

ACKNOWLEDGMENTS

We thank the herbarium curators of MO, NY, PH, and US for specimen loans. We greatly appreciate Richard and Nancy Cobb for locality logistics as well as continued support and encouragement. Also, the assistance of Guy Nesom with the Latin diagnosis was extremely helpful and generous. We are also grateful to Richard Buckner for photographing the type specimen.

REFERENCES

Baum, D.A. and M.J. Donoghue 1995. Choosing among alternative "phylogenetic" species concepts. Syst. Bot. 20:560–573.

Berkeley, M.J. 1866. [Not seen. Quoted in Weatherby, C.A. 1949. Rare Scott's spleenwort: one chance in a thousand. Horticulture 27:85, 119.]

Eaton, D.C. 1873. Asplenium eb[e]noides. Bull. Torrey Bot. Club 4:17–18.

Maxon, W.R. 1900. Notes on the validity of *Asplenium ebenoides* as a species. Bot. Gaz. 30:410–415.

Mayden, R.L. 1997. A hierarchy of species concepts: the denouement in the saga of the species problem. In: M.F. Claridge, H.A. Dawah, and M.R. Wilson, eds. Species: the units of biodiversity. Chapman & Hall, London. Pp. 381–424.

Mayr, E. 1963. Animal species and evolution. Harvard University Press, Cambridge, MA.

Scott, R.R. 1865. Description of a new Am[erican] fern. Gard. Monthly 7:267–268.

Slosson, M. 1902. The origin of *Asplenium ebenoides*. Bull. Torrey Bot. Club 29:487–499.

Smith, D.M. and D.A. Levin. 1963. A chromatographic study of reticulate evolution in the Appalachian *Asplenium* complex. Amer. J. Bot. 50:952–958.

Underwood, L.M. 1896. The habitats of the rarer ferns of Alabama. Bot. Gaz. 22:407–413.

Wagner, W.H. Jr. 1954. Reticulate evolution in the Appalachian Aspleniums. Evolution 8:103–118.

Wagner, W.H. Jr. 1969. The role and taxonomic treatment of hybrids. Bioscience 19:785–789.

Wagner, W.H. Jr., R.C. Moran, and C.R. Werth. 1993. Aspleniaceae. In: Flora of North America Editorial Committee, eds. Flora of North America Vol. 2. Oxford University Press, New York. Pp. 229–245.

Wagner, W.H. Jr. and R.S. Whitmire. 1957. Spontaneous production of a morphologically distinct, fertile allopolyploid by a sterile diploid of *Asplenium ebenoides*. Bull. Torrey Bot. Club 84:79–89.

Walter, K.S., W.H. Wagner Jr., and F.S. Wagner. 1982. Ecological, biosystematic, and nomenclatural notes on Scott's spleenwort, × *Asplenosorus ebenoides*. Amer. Fern J. 72:65–75.

Werth, C.R., S.I. Guttman, and W.H. Eshbaugh. 1985a. Recurring origins of allopolyploid species in *Asplenium*. Science 228:731–733.

Werth, C.R., S.I. Guttman, and W.H. Eshbaugh. 1985b. Electrophoretic evidence of reticulate evolution in the Appalachian *Asplenium* complex. Syst. Bot. 10:184–192.

Wherry, E.G. and H.W. Trudell. 1930. The *Asplenium ebenoides* locality near Havana, Alabama. Amer. Fern J. 20:30–32.